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REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND THE LATE

CAPTAIN FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

THE LATE

Sir C. WYVILLE THOMSON, Knt., F.R.S., &c.

REGIUS PROFESSOR OF NATURAL HISTORY IN THE UNIVERSITY OF EDINBURGH
DIRECTOR OF THE CIVILIAN SCIENTIFIC STAFF ON BOARD

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PART XLI.—REPORT ON THE MARSENIADÆ.
BY DR RUDOLPH BERGH.

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EDITORIAL NOTE.

The present Memoir forms Part XLI. of the Zoological series of Reports on the Scientific Results of the Expedition.

On the return of the Expedition to England, the whole of the Mollusca, except the Cephalopoda and Pteropoda, were placed in the hands of the Rev. Robert Boog Watson, F.L.S., for examination and description. After separating out the whole collection and labelling the greater number of known species, Mr Watson found it necessary to limit his investigations to the larger groups of the Gasteropoda and Scaphopoda. The collection of Lamellibranchiata was subsequently handed over to Mr E. A. Smith, and his Report has been already published. The Nudibranchiata and the Marseniadæ were placed in the hands of Dr R. Bergh, whose Report on the former has been already published, while the results of his investigations upon the latter are given in the following pages.

John Murray.

Challenger Expedition Office, 32 Queen Street,
Edinburgh, *August* 9, 1886.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the MARSENIADÆ collected by H.M.S. CHALLENGER during the Years 1873–76. By Dr RUDOLPH BERGH, Physician to the General Hospital of Copenhagen.

INTRODUCTION.

THE family of the Marseniadæ has slowly gathered round the *Helix perspicua*, first defined by Linné in the tenth edition of his Systema Naturæ,[1] and the *Bulla latens* of O. Fr. Müller.[2] These forms, without an externally visible shell, were left for long unnoticed, until M. Sars[3] recalled attention to *Bulla latens*, while Cuvier[4] had meantime investigated a form nearly related to that mentioned by Ström and by Linné, and had described it under the name of *Sigaret*, which he borrowed from Adanson. A form at least congeneric (*Lamellaria tentaculata*) was described by the English naturalist Montagu,[5] and referred by him to his genus *Lamellaria*. The resemblance, however, between the title bestowed by Montagu and the generic designation of a group of Algæ (*Laminaria*, Lamouroux), as also the fact that the name *Lamellaria* cannot be fitly applied to the first and typical section of Montagu's genus, led Leach to advocate the disuse of the term. About 1819, in the British Museum, and a year later in his Synopsis,[6] he applied

[1] Syst. Nat., 1758, ed. x. t. i. p. 775, No. 620.

[2] Zool. Dan. prodr., 1776, p. 242, No. 2923.

[3] M. Sars, Beskriv. og Jagttag. over nogle mærkelige eller nye i Havet ved den Bergenske Kyst levende Dyr. Bergen, 1835, p. 67 (*Isis*. 1837, p. 754 (*Sigaretus Strœmii*)).

[4] *Bull. Soc. Philom. Paris*, Oct. 1799, No. 31, p. 32.—Sur l'Haliotide, le Sigaret, &c. (Mém. sur les Moll., 1817, No. 18).

[5] *Trans. Linn. Soc. Lond.*, 1811, vol. xi. p. 179.

[6] The opinion of Herrmannsen (Ind. Malacoz. primordia, t. ii. p. 23) that Müller's *Bulla latens* should be the type of the genus, is really based only on the fact that this species was labelled *Marsenia latens* in the collection of northern Molluscs sent by H. Beck (Museum Christiani viii.) to the assembly of naturalists at Kiel in 1847.

the generic terms *Oscanius*[1] and *Cleanthus* to the first group of Montagu's *Lamellariæ* (*Lamellaria membranacea*), but regarded these only as subgeneric divisions within Cuvier's genus *Pleurobranchus*. For the remaining group, here under discussion, he rejected the misleading designation *Sigaretus*, and formed the title *Marsenia*. As the type[2] of the new genus he proposed *Bulla haliotoidea*, Mtg., Test. Brit. (= *Lamellaria haliotoidea*, Linn. Tr.), but, in order to obviate ambiguity, changed the name to *Marsenia producta*.

Somewhat later (1824) Blainville described a form, from the Isle de France, quite different from, but yet allied to the "Sigarets" of Cuvier, the *Lamellariæ* (p.p.) of Montagu, and the *Marseniæ* of Leach, and established for it the genus *Coriocella*.[3] This, however, turned out to be a Marseniad with a very thin shell, which had fallen off the specimen described by Blainville, as was indeed soon remarked both by Gray[4] and Cuvier.[5] Blainville wished to transfer the name *Sigaretus* to related forms with distinctly developed internal shell, but of the two species which he included in this group, only one bears the characters of the genus, while the other (*Sigaretus haliotoideus*, Martini, vol. i. Taf. 16, Figs. 151–154) belongs to the genus *Stomatia*, Hill (*Cryptostoma*, Blainville). In the article "*Sigaret*" in the 49th volume of the Dict. Sci. Nat., which appeared a few years later, the statement of the generic characters is unaltered, while the number of included species is increased to eight, of which, however, six at least are forms of *Stomatia*. (Here Blainville also seemed much inclined to regard the *Helix perspicua* of Linné as a *Pleurobranchus*.) Some years later (1830) Menke adopted the recently established designation *Cryptostoma*, using it as a synonym for "*Sigaretus*, Lamarck, Sow." (!), and proposed in verbal contrast the name *Cryptothyra*[6] for Blainville's *Coriocellæ*; while Swainson[7] afterwards suggested the term *Chelinotus*.

The group which had gathered round the *Helix perspicua* of Linné had thus received six names: "Sigarets" from Cuvier (1799), *Lamellariæ* from Montagu (1811), *Marseniæ* from Leach (1819), *Coriocellæ* from Blainville, *Cryptothyra* from Menke (1830), and *Chelinoti* from Swainson (1840). This had, so far, its explanation in the imperfection and insufficiency of Cuvier's first investigation and descriptions, which made it almost impossible for other investigators to know what form Cuvier had before him. Nearly all are agreed, at least, in rejecting the originally indefensible and misleading name *Sigaret*, *Sigaretus*. Montagu's title *Lamellaria*, if used to denote the first of Montagu's species, that is, a form of *Pleurobranchus*, would become identical with the *Oscanius* or *Cleanthus*

[1] *Nec Oscana*, Bosc (a parasitic Crustacean).

[2] Leach, Synopsis of Brit. Moll., 1820 (*teste* Gray, *Ann. and Mag. Nat. Hist.*, Oct. 1847, vol. xx.); see *Oken*, *Isis*, 1823, Bd. ii. p. 460 (Mus. Paris).—Leach, Moll. Brit. Synopsis (ed. Gray), 1852, p. 26.

[3] Dict. Sci. Nat., 1824, t. xxxii. p. 259.—Man. de Malacol., 1825, p. 466.

[4] Gray, Spicilegia Zoolog., 1828, pt. 1, p. 4; cf. also Gray, Proc. Zool. Soc. Lond., 1847, p. 143.

[5] Cuvier, Règne animal (ed. 2), 1830, vol. iii. p. 90.

[6] Menke, Synopsis (ed. 2), 1830, p. 87.

[7] Swainson, A Treatise on Malacology, 1840, pp. 234, 355.

of Leach. In the earlier works of Gray[1] and of T. Brown,[2] the designation *Lamellaria* ("*Laminaria*")[3] seems to be used in this sense. The name "MARSENIA," on the other hand, which, under the circumstances, would be for many years little known outside of England,[4] was first adopted by Oken,[5] and afterwards applied to the group by Wood,[6] Beck,[7] and others, but more especially and consistently in my monograph.[8] Lovén, who had formerly,[9] like Férussac,[10] Johnston,[11] d'Orbigny,[12] and later Gray,[13] adopted the term *Lamellaria*, Mtg., with the other names appended as synonyms, afterwards[14] employed the title *Coriocella*, Blainville, to designate the typical forms, and restricted the generic name *Lamellaria* to a new and divergent genus. This proceeding had neither justification nor resulting benefit, quite apart from the fact that Blainville had originally founded the genus on a faulty characterisation, which, as Philippi[15] pointed out, was only applicable in Cuvier's corrected version. The *Coriocellæ* of Blainville are moreover not typical, and the name is therefore hardly applicable to the perfectly typical forms. Menke's term *Cryptothyra* is to be rejected as superfluous, while the name *Chelinotus*, given by Swainson to a form certainly closely allied to the *Coriocella nigra* of Blainville, must, as a generic or subgeneric designation, displace the misused and misleading term *Coriocella*.

Various faunists (Delle Chiaje, Gould, Michaud, Audouin, &c.) gradually increased the number of "species," but with the exception of Lovén (*loc. cit.*) did almost nothing to further the general or anatomical knowledge of the group. The first important contribution towards this end was my monograph (1853), which treated of the genera *Marsenia*, *Chelyonotus*, *Marsenina*, and *Onchidiopsis*. Owing especially to the scanty material, very much still remained, however, to be done to elucidate anatomical structure. My monograph

[1] London Med. Repos., 1821, p. 232: A natural arrangement of Mollusca according to their internal structure.]

[2] Illustrations of the Conchology of Great Britain and Ireland, 1827.

[3] This term was revived by Clark (On the Conovulidæ, &c., *Ann. and Mag. Nat. Hist.*, 1850, ser. 2, vol. vi. p. 451).

[4] The term must have been known to Blainville, who investigated several new molluscs in the British Museum, and instituted there his genus *Cryptostoma*.

[5] *Isis*, 1823, vol. ii. p. 460.

[6] *Ann. and Mag. Nat. Hist.*, 1842, vol. ix. p. 455, sp. 527.

[7] *Amtl. Ber.* 24^te *Versamml. d. Naturf. u. A. in Kiel*, 1846, p. 116.

[8] R. Bergh, Bidrag til en Monogr. af Marseniaderne, 1853, *Kgl. Danske Vidensk. Selsk. Skr.* 5 R. Naturv. og mathem. Afdel. iii. pp. 243–359, tab. i.–v.

[9] Lovén, Index Moll. Scandin. occid. habit., 1846, p. 15.

[10] Tableaux systémat. des Anim. Moll., 1822, p. xvi.

[11] *Mag. Nat. Hist.*, 1836, vol. ix. p. 229.

[12] Voy. dans l'Amér. mérid., p. 403.

[13] Figures of Moll. Animals, 1850, vol. iv. p. 75.—Guide, 1857, vol. i. pp. 27 and 28 (*Ermea*).

[14] *Öfversigt k. Vetensk. Akad. Handl.*, 1847, p. 192.

[15] Philippi, Berichtigung von Berichtigungen, Sigaretus und Lamellaria. *Archiv f. Naturgesch.*, 1841, Jahrg. vii., Bd. i. p. 343.—Enum. Moll. Sic., 1844, t. ii. p. 142.

was soon followed up by my research on *Marsenina prodita*.[1] Subsequently H. v. Jhering[2] contributed an investigation of the nervous system of *Marsenina perspicua*, and G. O. Sars[3] finally published a research on the oral parts of *Marsenia latens*, *Marsenina prodita*, and *Onchidiopsis glacialis*. By several naturalists, especially Dall and Verrill, some new, but more or less doubtful, species have been added.

Even the Challenger expedition has made but scanty contributions to the group; it has however brought to light a generic form of great interest.

Family Marseniadæ (Leach), Bergh.

Marsenia, Leach, 1820, Moll. Brit. Synopsis (ed. Gray), 1852, p. 26.
Lamellariacea, Lovén, Öfvers. Vet. Akad. Handl., 1847, p. 192.
Lamellaridæ, Gray, Figures of Moll. Anim., 1850, vol. iv. p. 75.
{ *Lamellariadæ*, Gray, Guide, 1857, vol. i. pp. 27, 28.
{ *Velutinidæ*, Gray, p.p. (*loc. cit.*), 1857, p. 46.
Marseniadæ, Bergh, Monogr. (*loc. cit.*), pp. 243–359, tab. i.–v.
{ *Marseniadæ*, Troschel, Das Gebiss der Schnecken, vol. i., 1856–1863, pp. 185–188, pl. xvi. figs. 1–5.
{ *Velutinidæ*, Troschel, p.p. (*loc. cit.*), pp. 167–169, pl. xv. figs. 17–19.

Mollusca gastræopoda prosobranchiata (streptoneura, azygobranchiata).

Pallium ampliatum, incrassatum, supra lævе vel nodulosum vel grosse tuberculatum; vel continuum, testam recondens, vel culmine fissum, testam pro parte detegens. Limbus pallii vel amplus et planus, vel crassior et rotundatus, ultra margines podarii productus; pro siphone antice in pagina inferiore limbi semicanali exaratus cum plica marginali vel emarginatura; in medio lateris dextri limbi interdum semicanalis et plica similis.

Testa semper adest, ut plurimum obtecta, interdum partim denudata;—tum spiraliter convoluta, paucigyra, calcarea, tenuis, semper absque margarita; *apertura ampla*, margine columellari simplici arcuato, antice vix cum flexuræ vel emarginaturæ vestigio;—tum cornina, scutiformis, absque spira.

Cavitas branchialis duabus branchiis instructa; altera spuria, antica, minore, foliolis homomallis; altera vera, postica, majore, foliolis secundis.

Caput depressum, antice truncatum. Tentacula quasi ex angulis capitis orta, teretia, basi depressa, vel subcylindrica vel subconica; oculi in tentaculorum basi externa sessiles, quasi ophthalmophoriis brevibus inserti.

Rostrum retractile, sat longum, validum, per rimam oralem inferiorem transversalem (os externum) exsertile; os internum utrinque lamina mandibulari cornina validiori

[1] R. Bergh, Bidrag til en anat. Unders. af Marsenina prodita (Lovén), *Vid. Meddel. nat. Foren. Kjøbenhavn*, 1857, pp. 110–122, tab. i.

[2] H. v. Jhering, Vergl. Anat. des Nervensyst. u. Phylogenie d. Mollusken, 1877, pp. 115–117.

[3] G. O. Sars, Moll. reg. arct. Norv. 1878, pp. 150–153.

armatum. *Radula* linearis, valida, postice in vaginam libere prominentem, longam, sæpius quasi spiraliter involutam continuata. Armatura radulæ mire diversa. Dens medianus semper solitarius, margine basali posteriori bifido vel truncato; apice recurvato cum acie unicuspide et utrinque denticulata. Dentes pleurales numero varii; semper lateralis internus validus, interdum præterea uncini duo externi.

Podarium oblongum, antice truncatum, subemarginatum, margine antico sulco exaratum; postice nonnihil acuminatum, apice subrotundatum (operculo lobuloque operculigero nullis).

Animalia pro parte dioica, pro parte monoica. *Penis* validissimus, pone tentaculum dextrum exsertus, sat compressus; interdum falcatus, apice incurvatus; interdum involutus; sub inertia intra marginem cavitatis branchialis recondendus. Apertura genitalis feminina, *vulva*, verruca perforata intra angulum dextrum fissuræ branchialis sita.

Animalia marina, ut plurimum solitaria, segnia, ova in cavitates Ascidiis compositis vel Spongiis excavatas deponentia. Embryones testa externa provisoria carinis compluribus instructa.

The Marseniadæ have a somewhat round or oval contour, and are generally almost hemispherical. The dorsal surface (*pallium*) is either smooth, or covered with a variable number of large, bluntly conical or more spherical tubercles. The shell is either altogether enveloped in the mantle, or is partially exposed at a round or oval opening on the middle of the back (*Marsenina*). It covers the whole of the respiratory apparatus (*Onchidiopsis*), and usually the whole of the upper visceral mass; at the edge of the wide opening it is intimately united to a rather thick flat band, the shell-fillet. The shell may have a shield shape, without a trace of spiral-turning, and is then of a horny nature (*Onchidiopsis*); or it may be almost horny and with a hint of a spiral (*Marseniella*); usually, however, it is wound in a small spiral with few turns, of which the last is very wide, and in this case the shell is always calcareous, but very delicate and brittle. On the inner side of the last turn of the shell there are usually two (frequently indistinct) muscle-facettes, one somewhat anteriorly to the left, the other posteriorly to the right. The *border of the mantle* is very well developed, projecting all round, and usually completely covering head and foot, with the exception of the tip of the tail. It is usually flattened and surrounds the upper portion of the body as a border of varying breadth; occasionally it is thicker, rounded at the margin, and somewhat flattened on the lower side (*Marseniopsis, Onchidiopsis*). There is no proper, markedly protruding siphonal structure; but this is replaced by a semi-canal on the under side of the mantle, which twists the border upwards in a protruding fold, or ends between two finger-like prolongations (*Chelyonotus*). This semi-canal ends at the left corner of the anterior end of the gill-cavity. Besides this *inhalent* canal there is in some genera (*Marsenina, Onchidiopsis*), on the right side, a perfectly similar *exhalent* canal, ending at the right corner of the branchial cavity. The *branchial cavity* is wide and spacious, but depressed. On its roof are fixed the two so-called branchiæ, the anterior

"false gill"—pennate, but attached to the wall almost throughout its entire length and breadth,—the posterior "true gill" with leaflets along one side. These thin leaflets, which form the *functional gill*, lie closely together, arranged along a curved transverse line, and slanting down from the base of attachment into the branchial cavity. The leaflets vary in breadth; in the more typical genera (*Marsenia*, *Marseniella*, *Marseniopsis*) they bear laterally either transverse ridges or small secondary leaflets. Behind the gill, on the roof of the cavity, lies a *kidney* of some considerable length (*Marseniella*), which may, however, be smaller, and situated on the left. To the left, at the end of the kidney, the *pericardium* is seen. Behind the gill there is usually a space covered by the whitish "secreted substance" of the kidney, or of the "foliated gland," or of both. Lastly, behind gill and kidney, over the whole breadth of the branchial cavity, there lies the usually broad *foliated gland*. On the roof of the cavity, in a more median and posterior position, or else to the left, lies the *external, branchial aperture of the kidney and foliated gland*. At the right-hand corner of the branchial space is situated the more or less protruding *anal papilla;* behind this in the female dicœcious Marseniadæ lies the *vulva*, and in the monœcious forms (*Marsenina*, *Onchidiopsis*) the female generative aperture.

The lower part of the body, below the branchial cavity, is smaller than the superior portion, and includes the central nervous system, the whole anterior portion of the digestive organs, and a large part of the *vas deferens*. The *head* is somewhat large and flattened, truncated in front, sometimes slightly indented, and drawn out on each side into an anteriorly-directed tentacle. The *tentacles*, springing from the side of the head, are somewhat flattened at their base, but are otherwise conical or cylindrical. The *eyes* are nearly sessile at the base of the tentacles, or seated on short ophthalmophores. The *external mouth-opening* is situated on the under surface of the head, usually at a little distance from the anterior end, and forms a transverse slit; sometimes (*Marsenina*, *Onchidiopsis*) it lies further forward, and is then a more roundish opening. Through the external mouth the rostrum is protruded. The *foot* is powerful,[1] and with the exception of the end of the tail, is wholly overlapped by the border of the mantle, on which, however, the animal does not seem to rest when creeping.[2] The foot is somewhat long and narrowed posteriorly, ending in a rounded point. The anterior border exhibits a deep groove, in which the *pore of the foot-gland* opens medially. The edges of the foot project but slightly, and the tail is not short. The border of the foot is sometimes peculiarly thickened (*Onchidiopsis*). The *penis* is always strongly developed, and though not retractile, can be hidden, during quiescence, within the limits of the branchial cavity. The whole organ is more or less compressed, usually plano-convex, and with the edge bent or somewhat

[1] Quite erroneous is the statement made by Adams, L. Reeve, and especially by Keferstein (Bronn, Kl. u. Ordn. d. Thierreichs, Bd. iii., Malacozoa, 1864, p. 1057), according to which the foot "almost entirely conceals the shell," and the enveloping mantle is regarded as a development of the *Lobus operculigerus*.

[2] This seems, however, to be the case in *Pyrula;* cf. Örsted, *Vid. Meddel. nat. Foren. i Kjøbenhavn*, 1850, p. 9.

rolled up (*Onchidiopsis*). It is sometimes broadened (*Marsenia*), sometimes narrowed at the apex (*Onchidiopsis*). The seminal duct runs along the whole length of the penis, and its end can usually be stretched out in a finger-like protrusion.

The *central nervous system* exhibits a structure in general agreement with that of the other azygobranch streptoneural Gasteropods,[1] and essentially differs from that of some of them (*Cassidaria*), only in the shortening of the proximal ends of the pleural (visceral) commissure. Each half of the *superior ganglionic mass* exhibits three ganglia lying in close association; on the left—a cerebral, a pleural, and (usually on the upper side of them) a supra-intestinal (siphonal ganglion of Jhering) lying on the latter; on the right, side by side—a cerebral and a pleural, with a subintestinal (abdominal of Jhering) situated behind and beneath them. The cerebral ganglia are connected by a rather short commissure, and give origin to the usual nerves and to the cerebro-pleural and cerebro-pedal connectives. Similarly, from the pleural ganglia there originate the usual nerves and the pleuro-pedal connective; the right ganglion is united superiorly and to the left with the supra-intestinal, posteriorly and inferiorly with the sub-intestinal, and through the latter with the left pleural ganglion, which is again connected with the supra-intestinal. It is probable that the sub-intestinal ganglion is further connected with the supra-intestinal by a special commissure included in the pleural (visceral). The supra-intestinal, situated on the left, sends nerves to the gill, to the olfactory organ, and to the left half of the mantle. The subintestinal, situated on the right, supplies principally the digestive system and the right half of the mantle. The relations of the buccal ganglia are as usual.—The *inferior or pedal ganglionic mass*, lying in close connection with the foot, is linked to the superior by the cerebral and pleural connectives; the connectives of the right side are, however, usually (*Chelyonotus*, *Marsenia*, *Marseniella*, *Marseniopsis*) much shortened. From the anterior portion of the pedal ganglia a small round secondary ganglion is always separated off, and from this the anterior part of the foot is innervated.

The *eyes* are, as we have mentioned, situated on small knobs (*ophthalmophores*) at the base of the tentacles. The *otocysts* are inclosed in flat, milk-white sheaths, formed of connective substance, and are situated on the side of the pedal ganglia, or somewhat more externally. The *Nervus acusticus* ascends through the cerebro-pedal connective to the cerebral ganglion. The otolith is large and spherical.

The bipinnate *olfactory organ* lies in a special groove in front of the gill, and is attached to the shell-ridge by a fine fold, through which the *Nervus olfactorius* runs from the supra-intestinal ganglion. The organ itself consists of a rhachis enclosing the nerve, and of rather large leaflets springing from the rhachis. The *skin* is well supplied with glands, especially in the mantle. On the anterior border of the foot, there is a small gland, the *foot-gland*, which opens by the previously mentioned pore.

[1] Cf. Spengel, Die Geruchsorgane u. das Nervensystem d. Mollusken, *Zeitschr. f. wiss. Zool.*, 1881, vol. xxxv. p. 373.

The Marseniadæ possess a *protrusible* rostrum. The *external mouth*, situated either at a short distance from the anterior border and then transverse, or further forward and then round, leads into the rostral cavity—the retracted rostrum. When the retraction is complete, the *internal mouth*, the entrance to the bulbus pharyngeus, is seen on the floor of the cavity as a narrow aperture. When the retraction is only half complete, the rostrum appears within the rostral cavity as a short truncated body, with the interior mouth at its apex and sometimes visible at the external opening. When protrusion is complete, the rostrum is seen as a cylindrico-conical prolongation of some length with the internal mouth at its apex, and with the bulbus pharyngeus therefore within. The internal mouth is surrounded by a flat, narrow lip, and is lined internally on each side by a rather flat, horny *mandibular plate*. These are either prominent, strongly developed, almost homogeneous structures, with the anterior border specially thickened (*Chelyonotus, Marsenia, Marseniella*); or they are somewhat narrow plates of a slighter nature, composed of rods arranged in indistinctly separable rows (*Marseniopsis*); or, further, they may resemble the latter in some respects, but with a stronger development, and consist of regular, obliquely transverse rows of component elements with a denticulated anterior edge (*Marsenina*), and occasionally with a specially strong compound prong in addition (*Onchidiopsis*). The *bulbus pharyngeus* is well developed, especially in the *Chelyonoti;* the anterior portion, with the mandibular plates, is bent slightly downwards; at each side of the posterior end there is a peculiar "cartilaginous patch," formed from the posterior extremity of the tongue-cartilage, and like it serving for the insertion of muscles. From the middle of the posterior end extends the somewhat long radula sheath, bent usually first down and then up, and often with a slight spiral twisting. The short broad *tongue*[1] bears very varied armature in the different members of the group. Usually a strong lateral plate lies on each side of the middle one; in some genera (*Marseniopsis, Marsenina, Onchidiopsis*) two external hooks are also present. The number of rows of teeth in the *Marseniadæ* is, as in the related families, by no means small, amounting in all, including both those on the tongue and those in the sheath, to between 42 and 92. They are most numerous in the *Onchidiopsides* (as many as 92), and *Marseniopsides* (as many as 72). The median plates have the posterior margin truncated, or deeply cleft (*Marsenia, Chelyonotus, Marseniella*); the anterior edge is bent upwards, and exhibits small denticles at each side of the strong point. The strong lateral tooth-plates usually have the broad dorsal portion deeply cleft, or only superficially grooved (*Marsenina, Onchidiopsis*). When the tongue is shortened, the point of the body of each of these teeth is pushed into the groove of the plate behind. The strong hook of these plates is toothed on both edges, more finely on the superior (posterior). The two external hook-like plates are but slightly developed, the hooks are not denticulated, or exhibit only a few fine teeth.

There are apparently no proper salivary glands.

[1] Delle Chiaje seems to have observed the lingual cavity in his *Helix neritoidea*.

The *œsophagus* is relatively short and wide, and is frequently somewhat enlarged below into a sort of crop. It descends to the right, or to the left, or sometimes directly backwards. In some genera (*Chelyonotus*, *Marsenia*), the canal is connected before the cardia with a saccular *proventriculus*, which lies along the right of the anterior side of the foliated stomach, and further forward. The œsophagus opens into the lower anterior portion of the altogether peculiar *foliated stomach*. This organ has a cap-like form, due to its more or less hollowed-out anterior portion, and is arched posteriorly. The small and flattened cavity communicates anteriorly with the œsophagus, and is continued posteriorly to the true stomach; the wall is very thick, and formed of a number (usually 10 to 20) of glandular dissepiments, which lie at right angles to the cavity. The whole stomach is more or less completely surrounded by a thick *glandular layer*, which is especially well developed inferiorly, frequently almost enveloping the pedal ganglia, and sometimes extending further forwards. This glandular mass may perhaps represent the salivary glands, but it does not communicate either with the rostral cavity or the bulbus pharyngeus. From the posterior side of the foliated stomach a short gut goes obliquely upwards through the thin but firm partition between the inferior and superior body-cavities, and through the liver to open into the stomach proper on its anterior and lower wall. The *true stomach* is of a roundish shape, has a considerable width, and exhibits, besides the cardiac opening, several wide bile-duct apertures. It is continued on without marked boundary into the intestine, and is seen (as also the posterior portion of the latter) shining through on the posterior surface of the upper visceral mass. Elsewhere it is enveloped by the liver. The *intestine* appears at first as the narrowed continuation of the stomach; it then extends to the left, and, just in front of the pericardium, bends with a knee-like curve into the anterior stretch, which runs along on the right of the front side of the liver. Finally, twisting forwards, it ends in the anal papilla, at the right corner of the branchial cavity.

The contents of the digestive cavity were for the most part unrecognisable animal remnants (probably mostly of Alcyonidæ and Ascidians). In the intestine these appeared usually as oval or short sausage-shaped, white or darkish, firm masses of excrement.

The *liver*[1] exhibits the ordinary structure. It is penetrated by a network of bile-ducts, which are wide terminally, and open by several round apertures into the true stomach.

The pericardium, the heart, and the vascular system do not seem to differ essentially from those of other Prosobranchiates.

The *kidney* is usually comparatively small, and situated on the left; it occasionally attains a larger size, becoming broadened out posteriorly (*Onchidiopsis*); or it may lie transversely behind the branchia (*Marsenina*). The structure agrees with that in other *Prosobranchiata*. It communicates by a fine pore with the pericardium, and opens by a slit on the left into the branchial cavity.

[1] Cf. Barfurth, Ueber den Bau u. die Thätigkeit der Gasteropoden-Leber, *Archiv f. Mikr. Anat.*, 1883, Bd. xxii. pp. 473–524, taf. xx.

Behind the gill and the kidney, on the anterior edge of the liver, and partly resting on the intestine, lies the *foliated gland* ("Feuillets muqueux," Cuv.; "Schleimdrüse" of some authors). It exhibits the usual structure, and seems to open into the branchial cavity by the same aperture as the kidney.

Most of the Marseniadæ are, like the other Prosobranchiata, *diœcious*, unisexual. The reproductive gland, *testis* or *ovary*, forms the termination and the posterior portion of the last twist of the superior visceral mass. They are both composed of long attenuated follicles.

The *vas deferens* forms a large coiled knot, with which the windings of a tubular, appendicular, *prostate* organ are associated. It is continued from the superior visceral mass to the right wall of the inferior body-cavity, within which it extends with many twistings to the penis, through which it is further prolonged to an opening at the tip. Less frequently (*Marsenia, Marseniella*) the *vas deferens* passes, at the root of the penis, from the body-wall into the body-cavity, where it becomes more strongly developed, and extends with multitudinous coils over the *foliated stomach* and the bulbus pharyngeus, finally entering the penis. The terminal portion of the *vas deferens* is, in most of the genera, free within its cavity, and can be protruded, like a finger, from the apical aperture, or on the other hand altogether retracted. The *penis* is, as we have mentioned, slightly different in the various genera.—The *oviduct* passes from the ovary into a large *mucus and albumen gland*, lying on the inside of the fasciculus of the right shell-muscle. Thence it is continued forwards as a comparatively short, but yet strongly developed *vagina*, which opens below the anal papilla. Just above the vulva, a special, short, strong-walled diverticulum is formed by the vagina. A number of minute *seminal receptacles* open into the posterior end of the mucus and albumen gland.

Among the Marseniadæ, however, several *monœcious*, bisexual genera occur (*Marsenina, Onchidiopsis*), a sexual relation not occurring elsewhere among Prosobranchiates, except in the but little known genus *Valvata*.[1] The *hermaphrodite gland* exhibits the usual structure; the *hermaphrodite ducts* are associated with a very peculiar *accessory hermaphrodite gland;* the common duct passing from the latter divides in the usual fashion. The male duct—the *vas deferens*—is associated with a tubular *prostate* rolled up into an irregular knot, and usually enveloping the greater part of the *vas deferens*. The duct is continued onwards, in the usual way, within the body-wall to the *penis*. The female portion forms a vaginal duct associated with an immense *seminal receptacle*, with a thick-walled *vestibular sack*, and with the large two-chambered *mucus and albumen gland*. The *vagina* opens by a small slit-like *vulva* below and behind the anal papilla. The above account is based on an investigation of the monœcious apparatus of the *Onchidiopsides*.

But little is yet known of the *ontogeny* of this group. In regard to the *Marseniæ* proper (*Marsenia perspicua*) the reports of Peach, Hennedy, and Giard enable us to

[1] Moquin Tandon, Observ. sur l'appareil génital des Valvées (*Mém. de l'Acad. sc. Inscript. et Belles-Lettr. de Toulouse*, sér. 4, 1852, vol. xi. p. 63); *Journ. de conch.*, 1852, vol. iii. pp. 244–248, pl. ix. figs. 3, 4.

state that they eat out round holes in composite Ascidians (*Leptoclinum maculosum*, *Polyclinum succineum*), and there deposit their ova. They shut the cavities with special lids which exhibit concentric rings, said to be produced by the rotatory movements of the animals. The *Onchidiopsides* seem to form cavities with somewhat similar lids in a Halisarcid (and probably also elsewhere). The brood-cavities contain, as Giard (*Marsenia*) and Bergh (*Onchidiopsis*) have observed, a number of nutritive ova which supply the developing embryos with food. Giard[1] has traced the general outline of the developmental history; according to him, two successive provisional shells are formed, the first nautiloid, the second simpler, exhibiting a greater resemblance to that of a *Carinaria*. Long before, however, Krohn[2] had noted that the larval shell of these animals does not develop into that of the adult, but that within the nautiloid shell, which is provided with several keels, a new shell is formed with a much greater resemblance to that of the adult *Marsenia*. The animal withdraws from the primary shell (which then disappears), and is finally covered only by the rudiment of the new persistent shell. Similar observations have been made by Macdonald[3] on South Sea forms, as the result of which it would seem that the *Jasonillæ* of Macdonald, the *Browniæ* of d'Orbigny, and the *Calcarellæ* of Souleyet are probably simply larval forms of *Marseniæ* or other Marseniadæ. I have also observed a larva with a somewhat similar, but much ribbed, primary shell, and this is probably to be referred to an Arctic *Onchidiopsis*.[4]

The Marseniadæ are found in all seas; particularly developed types mostly occur in tropical seas (*Chelyonotus*) and the Arctic Ocean (*Onchidiopsis*). As to their distribution in time, they seem (*Marsenia*) to have appeared late in the tertiary period.

Although the Marseniadæ form, both in habit and structure, a tolerably well-defined group, they differ among themselves not a little in both these respects, but especially in the armature of the tongue; and it is because of this that the different members of the family have been repeatedly severed from one another.[5] With the exception of the

[1] Giard, Sur l'embryologie du Lamellaria perspicua, *Comptes Rendus*, 22 Mar. 1875, pp. 736, 738, 739.

[2] A. Krohn, Üb. einen neuen mit Wimpersegeln versehenen Gasteropoden, *Archiv f. Naturgesch.*, Jahrg. xix., Bd. i., 1853, pp. 223–226, taf. xi. figs. x. i.–ii.

A. Krohn, Nachtr. zu dem Aufs. üb. die Echinospira diaphana, *Archiv f. Naturgesch.*, Jahrg. xxv., Bd. i., 1855, pp. 1–5, taf. i. figs. 1, 2.

A. Krohn, Fernere Nachtr. zu dem Aufsatze üb. die Echinospira, nebst Bemerk. üb. eine ihr verwandte Larve, *Archiv f. Naturgesch.*, Jahrg. xxiii., Bd. i., 1857, p. 252, taf. xii.

[3] Macdonald, Further Observations on the Metamorphosis of Gasteropoda, *Trans. Linn. Soc. Lond.*, 1860, vol. xxiii. pt. 1, p. 70.

[4] A similarly caducous larval shell appears to have been hitherto observed only in the *Cymbuliæ* (by Krohn), where the gelatinous shell of the adult seems to be an altogether independent formation.

[5] Troschel (Das Gebiss d. Schnecken, 1856–1863, vol. i. pp. 167, 185) placed the *Marseniæ* and the *Chelyonoti* next the *Naticaceæ*; the *Onchidiopsides* and the *Marseninæ* next the *Velutinaceæ*, as had been already proposed by Gray (Guide, 1857, vol. i. p. 46), who had incorporated the former in the Velutinidæ.

Gray wished (Guide, 1857, vol. i. pp. 27, 28) to divide the family into three generic groups, the *Coriocellæ*, the *Lamellariæ* (with *Lamellaria tentaculata* as type), and the *Ermeæ* (with *Ermea perspicua* as type); an unreasonable proceeding in every respect, as to names, characterisation, and grouping.

Marseninæ, which in their youth probably agree with the other members of the family, all possess a continuous, closed mantle, enveloping an internal shell. The edge is either broadened out into a border, or is narrow, thick, and somewhat rounded (*Marseniopsis*, *Onchidiopsis*). Besides the internal, anterior, inhalent fold and furrow, some genera (*Marsenina*, *Onchidiopsis*) also possess, on the right, a similar exhalent arrangement. The shell is usually calcareous, though sometimes it is almost (*Marseniella*), or altogether (*Onchidiopsis*) horny. The armature of the tongue is curiously varied, and it is on this ground alone that, as we have mentioned above, attempts have been made artificially to break up the group. The more typical forms exhibit one lateral plate on each side of the median (1–I–1); other genera (*Marseniopsis*, *Marsenina*, *Onchidiopsis*) possess, in addition, two external hooks (2–1–I–1–2). But the strangest internal difference is the fact, that, while the great majority of the Marseniadæ are, like other Prosobranchiates, unisexual, two genera, *Marsenina* and *Onchidiopsis*, are monœcious.

CONSPECTUS GENERICUS.

Armatura lingualis.	Plica expiratoria nulla.	1–I–1	pars inf. vas. def. non libera	*Chelyonotus*, Sw.	Diœcia.
			pars inf. vas. def. libera	*Marsenia*, Leach	
				Marseniella, Bgh.	
	Plica expiratoria.	3–I–3	Testa interna calcarea	*Marseniopsis*, Bgh.	
			Testa semi-interna calcarea	*Marsenina*, Gr.	Monœcia.
			Testa cornea	*Onchidiopsis*, Bgh.	

The systematic position of the family cannot, in the meantime, be stated with any certainty, owing to our inadequate knowledge of the anatomy of the Prosobranchiata as a whole, and especially of those groups which are most probably the near relations of the Marseniadæ. It can at least be affirmed that they stand in close relationship with the VELUTINACEÆ, which may, perhaps, even be afterwards denied the distinction of forming a separate family. My provisional researches have shown that the latter agree with the Marseniadæ in the form of the nervous system, in general anatomical structure, and especially in the possession of the peculiar foliated stomach. In their hermaphroditism and lingual armature (2–1–I–1–2), the Velutinaceæ are still more closely linked to the monœcious genera *Marsenina* and *Onchidiopsis*. Were it not for the genus *Marseniopsis*, which is again closely bound to the *Marseniæ* proper, one might be induced (with Gray and others) to separate the monœcious genera, and to unite them with the Velutinaceæ in one family. Meanwhile, however, the Marseniadæ, as above discussed, may be regarded as forming a united family.

I. *Marsenia*, Leach.

Animalia dicœcia pallio ampliato, supra continuo, antice plica et semicanali inspiratoria. Penis falcatus, apice dilatatus. Lamellæ branchiales lateribus plicis transversalibus instructæ.

Lamellæ mandibulares validiores, structura uniformi (quasi homogena). Dens medianus radulæ basi (fere semper) bifidus; dens lateralis magnus, dorso fissus, hamo curvato marginibus serrulato. Proventriculus non deest. Pars inferior varis deferentis in cavitate abdominali pro parte libera.

Testa interna calcarea, lactea, nonnihil diaphana, lævis, obovata, spirata, anfractibus vix tribus; spira ad $\frac{1}{4}$ longitudinis sita, prominenti, acutiuscula, anfractibus vix duobus; apertura ampla, ovata, patente usque in fundum spiræ, columella antice sinu levi excisa.

1. *Marsenia tentaculata* (Mtg.).
   Mare atlant. orient.
2. *Marsenia producta*, Leach.
   Mare atlant. orient.
3. *Marsenia perspicua*[1] (Linné).
   Var. (?) Morelli, Delle Chiaje.
   Mare mediterr.
4. *Marsenia dubia*, n. sp.
   Mare atlant. orient. (Cape Verde).
5. *Marsenia pellucida* (Verrill).
   Mare atlant. occid.
6. *Marsenia stearnsii* (Dall).
   Mare pacific. (Californ.).
7. *Marsenia orbiculata* (Dall).
   Mare pacific. (Californ.).
8. *Marsenia latens* (O. Fr. Müller).
   Mare atlant. or. sept.
9. (?) *Marsenia rangii*, Bgh.
   Mare antillense.
10. *Marsenia minuta* (H. Adams).
    Mare rubrum.
11. *Marsenia cabulana*, Bgh., n. sp.
    Mare philippin.
12. *Marsenia affinis*, Bgh., n. sp.
    Mare philippin.
13. *Marsenia gemma*, Bgh., n. sp.
    Mare philippin.
14. *Marsenia indecora*, Bgh., n. sp.
    Mare philippin.
15. *Marsenia isabellina*, Bgh., n. sp.
    Mare philippin.
16. *Marsenia diegœnsis* (Dall), n. sp.
    Mare pacific.
17. *Marsenia ophione* (Gray).
    Mare pacific. (Nov. Zel.).
18. *Marsenia Kerguelenensis* (Studer).
    Mare pacific. australe.
19. *Marsenia* (?) *translucida*, Blv.
    Hab.?
20. *Marsenia depressa*, Wood.
    Crag (Sutton).

II. *Chelyonotus* (Swains.), Bergh.

Animalia dicœcia, Marseniis propriis similia; sed plica respiratoria producta, apice interdum bifida. Lamellæ branchiales fere ut in Marseniis.—Lamellæ mandibulares et armatura lingualis fere ut in Marseniis, sicut proventriculus. Vas deferens in cavitate abdominali non liberum sed in pariete abdominali omnino inclusum.

Testa interna fere omnino ut in Marseniis sed magis calcarea.

1. *Chelyonotus semperi*, Bgh.
   Mare philippin.
2. *Chelyonotus tonganus* (Quoy et Gaim.).
   Mare indicum.
3. *Chelyonotus tuberosus* (Stimpson).
   Mare chinense.
4. *Chelyonotus* (?) *punctatus* (Stimpson).
   Mare chinense.

[1] The species indicated by larger italic type have been anatomically examined by the author. The bracket indicates that the species enclosed by it are nearly related to each other.

III. *Marseniella*, Bgh., n. gen.

Animalia dicœcia, Marseniis propriis similia. Lamellæ branchiales, lamellæ mandibulares et armatura lingualis ut in Marseniis. Proventriculus deest. Pars inferior varis deferentis ut in Marseniis libera.

Testa fere cornina; spira minuta; anfractus ultimus maximus, postice solutus.

Marseniella borealis,[1] Bgh., n. sp.
Mare arcticum orient.

IV. *Marseniopsis*, n. gen.

Animalia dicœcia forma generali Onchidiopsidibus similia, corpore ita quasi sphæroideo, quasi inflato, sed solummodo plica et semicanali (inspiratoria antica); os externum subanticum.—Lamellæ mandibulares minores, angustæ. Armatura lingualis fere ut in Marseninis et in Onchidiopsidibus (2—1—I—1—2).

Testa interna calcarea ut in Marseniis.

1. *Marseniopsis pacifica*, n. sp.
Mare pacificum.

2. *Marseniopsis murrayi*, n. sp.
Mare pacific.

V. *Marsenina*, Gray.

Animalia monœcia, Marseniis propriis similia, sed fissura pallii submediana partem testæ denudatam relinquente. Præter semicanalem anteriorem (inspiratoriam) semicanalis dextra (expiratoria) adest.—Lamellæ mandibulares fortiores e seriebus baculorum brevіorum compositæ. Armatura lingualis ut in Onchidiopsidibus; præter dentes laterales utrinque duo uncinati (2—1—I—1—2).

Testa semi-interna (dorso plus minusve denudata), calcarea, illi Marseniarum non dissimilis.

1. *Marsenina prodita* (Lovén).
Mare atlant.
2. *Marsenina glabra* (Couth.).
Mare atlant. occ.
3. *Marsenina ampla*, Verrill.
Mare atlant. occ.
4. *Marsenina rhombica* (Dall).
Mare pacific. (Calif.).
5. *Marsenina grœnlandica* (Möller).
Mare grœnland.
6. *Marsenina dalli*, n. sp.[2]
Mare pacific.

VI. *Onchidiopsis* (Beck), Bergh.

Animalia monœcia, pallio sphæroideo, quasi inflato; præter plicam et semicanalem anteriorem (inspiratoriam) plica et semicanalis dextra (expiratoria) adsunt. Os externum

[1] The species indicated by larger italic type have been anatomically examined by the author.

[2] This remarkable species has the shell quite inclosed, and there is no trace of a fissure on the back.

subanticum. Penis compressus, quasi convolutus, quasi alatus, apice cylindrico obtuso. Margo lateralis podarii incrassatus.—Lamellæ mandibulares ut in Marseninis, sed prominentia dentiformi marginis anterioris instructæ. Armatura lingualis ut in Marseninis (2−1−I−1−2).

Testa interna cornina, scutiformis, non spirata.

1. *Onchidiopsis grœnlandica,*[1] Bgh.
Mare arcticum (atlant., pacific.).

2. *Onchidiopsis glacialis* (M. Sars).
Mare arcticum (atlant.).

[1] The species indicated by larger italic type have been anatomically examined by the author.

DESCRIPTIONS OF SPECIES.

Marseniadæ.

Marsenia, Leach.

The genus *Marsenia* proper was established by Leach as early as 1820. These animals are not of large size. The mantle, which is closed above, has a broad border, and there is only one sub-pallial respiratory fold and furrow, lying anteriorly, and leading into the left side of the branchial opening. The calcareous shell, which is entirely inclosed, has a small spiral with a somewhat wide opening, and with a distinct columellar sinus. The *Marseniæ* have large, lancet-shaped *branchial leaflets*, which are covered laterally with *transverse folds*. The *mandibular plates* are strongly developed, and composed not of rows of rods, but of a tolerably uniform (homogeneous) mass, with a broad biting or chewing margin. The *median tooth plates* of the tongue have their posterior margin almost always deeply cleft; the strong lateral plates have their hook denticulated on each margin, but unequally toothed. There is always a large *proventriculus*. The sexes are separate; the inferior portion of the *vas deferens* is quite *free*, partly covering with its coils the bulbus pharyngeus and the foliated stomach. The flattened, sickle-shaped penis is somewhat broadened terminally.

The true *Marseniæ* occur in all seas, both tropical and arctic. But little is known of their general biological relations. The ontogeny of a typical form has been partially followed.[1]

Marsenia dubia, n. sp. (Pl. I. figs. 1–6).

Habitat.—Eastern North Atlantic, off Cape Verde.

Only one specimen (a male) was found, on the 28th July 1873, near St Vincent, Cape Verde.

This small form measured 4·5 mm. in length, about 4 in breadth, and 1·75 in height. The general *colour* was whitish, and the yet whiter shell shimmered through the dorsal surface. In *form* it agreed with the typical *Marseniæ;* the respiratory fold of the mantle

[1] Cf. also my monograph of the Marseniadæ, which will shortly appear (1886, 1887), as Supplement III. to my Malacological Researches, in Semper's Account of his Travels in the Philippines: Reisen im Archipel d. Philippinen, &c.

margin was almost median; the upper surface of the mantle almost even; the border as usual, or somewhat narrower, with the ordinary radiating stripes on the lower surface. The *shell*[1] had a normal relative size, a small and but slightly protruding spiral, with the last turn extremely large. The shell was not specially thin, but somewhat hyaline, of a white colour, and exhibiting fine lines of growth. The internal (shell) surface of the mantle was quite colourless.

On removing the shell the muscle-facettes were seen as usual (fig. 2), and the *superior* visceral mass was arranged in the ordinary fashion. The pale yellowish-white reproductive organ (testis) (fig. 2, *b*), somewhat whiter at the extremity, lay posteriorly. At the posterior edge of the visceral mass, the stomach (fig. 2, *a*) and intestine were seen shining through. In front of the testis was placed the greyish foliated gland, through which the intestine with its white excrement masses (fig. 2, *c*) could be seen, while in front of the former extended a broad white stripe of secreted substance. Further forward lay the bow-shaped branchia, at its left end the small kidney (fig. 2, *d*) and the pericardium, with the heart shining through. In front of the gill the unusually large olfactory organ was situated (fig. 2, *e*). Through the roof of the *inferior* visceral mass or floor of the respiratory cavity, the viscera could be seen very much as usual; in front, the bulbus pharyngeus filling about half of the space, with the radula-sheath rolled up behind it, and further back the yellow "foliated stomach."

The *central nervous system* was of unusual relative size. The ganglia were in other respects exactly as in the typical *Marseniæ*, except that the infra-intestinal was perhaps somewhat larger; the pedal somewhat shorter and more triangular, possessing besides the usual secondary, short-stalked ganglion on the anterior end. The *tentacles* and *eyes* were as in the other *Marseniæ* (fig. 1). The *otocysts* also appeared as usual, with round, milk-white sheaths, lying just outside the pedal ganglia. They measured approximately 0·08 mm., and enclosed a yellowish otolith of about 0·05 mm. in diameter. The *olfactory organ* was, as we have mentioned, unusually large, exhibiting on each side about 20 rather thick folia.

The *bulbus pharyngeus* had the usual form, and was of a whitish colour; the cartilaginous patches were distinct, and the yellowish *mandibular plates* were perhaps a little longer than in the typical species. The *tongue* had the usual character, and possessed 11 rows of tooth plates, of which the 5 foremost were more or less injured. The radula-sheath was fully twice as long as the bulbus, and contained 28 developed, and 5 younger rows of teeth, making altogether 44. The plates were very faintly yellow; the median had a maximum length of 0·088 mm., with a breadth of 0·06 mm.; and the lateral were 0·12 mm. long. The *median* plates (figs. 4, 5, *a*) were longer than in the typical species; the hook and denticles (2–4 on each side) were typical, the left limb also a little longer than

[1] Owing to the minute size of the animal, it was impossible to remove the shell without breaking the last whorl.

the right. The *lateral* plates (figs. 5, *b*, *b*, 6) agreed with those of the typical form, exhibiting on the posterior (superior) cutting edge of the hook almost always about 12 comparatively fine denticles, and on the anterior (inferior) edge 4 very strongly developed.

The *œsophagus* did not differ from that of the other *Marseniæ*, it was posteriorly enlarged, and exhibited far back the usual somewhat long saccular dilatation. The *foliated* or *glandular stomach* had a yellowish colour, and a cap-like shape due to the concavity of the anterior surface; the stomach-cavity was as usual small, and the thick wall exhibited the normal foliated structure of a glandular character. This stomach was covered by the usual rather thick *glandular layer*. The slightly ascending pyloric tube opened into the *true stomach*, which lay along the right side of the posterior wall of the superior visceral mass. Near the pyloric opening was that of the bile-duct. The stomach was continued on the left into the *intestine*, which was throughout the greater part of its course filled with white, round or oval excrement balls. It was continued along the anterior surface of the liver, and further forwards (fig. 2). The contents of the digestive cavity were unrecognisable animal fragments. The *liver* was yellowish white, and in other respects as in other *Marseniæ*.

The pericardium and the heart, the kidney and the foliated gland, exhibited the usual structure and relations (fig. 2).

The faintly yellow *testis* was destitute of ripe gonoblasts. The *vas deferens* formed the usual twisted ball, and extended forwards in a straight, and afterwards in a coiled course, first within the body-wall, and then free to the *penis*. The latter (fig. 3, *a*) exhibited terminally an unusually marked protrusion (fig. 3, *b*) of the *vas deferens*.

This form of *Marsenia*, though somewhat doubtful, seems to differ from the Mediterranean species, though it is perhaps only a local variety.

Marseniopsis, n. gen.

The *Marseniopsides* differ strikingly from the other Marseniad genera. They form a beautiful transition-link between the diclinous and the androgynous (*Marsenina*, *Onchidiopsis*) Marseniadæ, and distinctly demonstrate a unity of relationship which makes it impossible to split up the family. In their general form *they agree with the Onchidiopsides;* the superior part of the body is hemispherical, as if distended; the mantle margin is thick and swollen; the external mouth lies far forwards. They have, however, *no right exhalent fold* nor associated semi-canal, and the branchial folia rather resemble those of the *Marseniæ*. The mandibular plates are narrower, and, on the whole, smaller, than in other Marseniadæ. The *lingual armature*, on the other hand, *agrees exactly with that of the androgynous forms;* outside the lateral teeth there are, in addition, two hooked plates. The *Marseniopsides* have the *sexes separate*. The anatomical relations resemble most closely those of the *Chelyonoti;* the inferior portion of the *vas deferens* does not lie

freely in the lower body-cavity; the penis most nearly resembles that of the *Marseniæ* proper. The *shell* is also, on the whole, like that of the typical Marseniæ.

The only representatives of the genus, as yet known, are the two new South Sea[1] species about to be described.

1. *Marseniopsis pacifica*, n. sp. (Pl. I. figs. 7–27).

Habitat.—Southern Ocean (Kerguelen Island).

Only one representative (female) of the species was obtained, by the dredge between 10 and 100 fathoms.

In its preserved state the animal measured 18 mm. in length, 13·5 in breadth, and 12 in height. The foot had a length of 13, and a breadth of mostly about 5·5 mm., increasing to 8 in front. The length of the tail was 6 mm., and that of the tentacles 4 mm. The *colour* of the upper surface was reddish yellow with several almost purple-red spots, and also apparently with scattered white nodules; the under surface of the animal was yellowish white.

The back was covered with coarse tubercles, very much as in the *Onchidiopsides*, which this form on the whole resembled. The respiratory canal measured 4–5 mm., was anteriorly bent slightly upwards, but otherwise exhibited the usual characters. The mantle border was thick, swollen, and not very broad. The ordinary stripes round the base of the foot were absent; the foot was as usual, except that the furrow of the anterior margin was very strongly developed, especially towards the middle line, where a slit-like hole was formed. The head and tentacles exhibited the ordinary form. The shell and the viscera were indistinctly seen as a greyish mass shining through the dorsal surface. The inside of the mantle, adjacent to the shell, was almost white. The shell (fig. 7) measured 15 mm. in length, about 12 in breadth, and 10 in height. The spiral was small, and exhibited two turns; the last turn was very large and much vaulted. Through the thin calcareous shell was seen the dark-grey coating of the superior visceral mass.

After removing the shell and the enveloping coat, the superior viscera exhibited the following arrangement (fig. 8). Far back lay the large, whitish, apparently granular ovary (fig. 8, *a*); in front of this was situated the large, very faint greenish-grey foliated gland (fig. 8, *b*), and across the lower surface of the latter the whitish intestine could be seen. Further forward to the right lay the faint yellow mucus- and albumen-gland, with the white rectum along the left side; both rectum and gland extended forwards. To the left was seen the roof of the branchial cavity, apparently of a white colour, owing to the presence of the secreted substance (fig. 8, *d*) of the kidney or of the foliated gland. Before

[1] According to a note which I made in 1873, in the British Museum, there is a specimen there, obtained in "Sholl Bay, Strait of Magellan," which might, perhaps, belong to this genus.

this white portion, to the left, lay the branchia, with the small kidney at its posterior left end, while in front, more to the left, the olfactory organ was situated, and at the posterior extremity of the latter, the pericardium. Near the hinder end of the mucus and albumen gland, the larger, right, triangular, shell-muscle facette arose (fig. 8, *c*); the left facette, which was longer, narrower, and on the whole smaller, lay on the left side of the anterior margin of the pericardium and posterior end of the olfactory organ. On the under side of the last turn of the shell, on the right, lay the ovary. Shining through, on the left side of this turn, the stomach could be seen for a short distance, of a grey colour, but elsewhere covered by the whitish liver.

The bulbus pharyngeus, the more distinct radula sheath, and the foliated stomach, were seen shining through the floor of the branchial cavity, and all exhibited the normal relations.

The *central nervous system* was in essential agreement with that of the typical *Marseniæ*. The arrangement of the ganglia was perfectly typical. Of the two cerebral ganglia, which lay anteriorly (fig. 10, *a*), the left was smaller than the right and less markedly separated from the pleural. The two pleural ganglia, which (fig. 10, *b*, *b*) lay behind the cerebral, were almost as large as the latter, and again the left was somewhat smaller than the right. The supra-intestinal ganglion, situated above the left cerebro-pleural mass, had (fig. 10, *d*) a long oval form, and was united by a very short connective with the left pleural, and by a long connective with the right (fig. 10). The infra-intestinal ganglion (fig. 10, *c*), was as usual compressed, had a somewhat bent form, and was superiorly connected with the right pleural by a short band, while inwards (to the left) it was united to the left pleural by a long connective. The pedal ganglia (fig. 11) lay beneath the others, and were almost entirely enveloped by a continuation of the white glandular layer covering the foliated stomach. They approached one another in the middle line, and each was short and irregularly pear-shaped, with the tubercle-like process (fig. 11, *a*, *a*) at the anterior end. The right pedal was connected as by a short process with the right cerebro-pleural mass, while the other was united to the left mass by two longer, separate, cerebro- and pleuro-pedal connectives (fig. 11, *b*, *b*). The buccal ganglia (fig. 10, *e*) were plano-convex, and were about a third the size of the cerebral. They were united by a commissure which was about twice as long as the diameter of the ganglia. The nerves seemed to originate in the same way as in the typical *Marseniæ*.

The *eyes* appeared as in the *Marseniæ* (fig. 9), and two white calcareous points visible below the pedal ganglia and embedded in the pedal musculature represented the usual *otocysts* (fig. 11, *c*, *c*). They measured about 0·24 mm. in diameter, and the dull calcareous, spherical otolith about 0·1 mm. The auditory vesicles seemed to be connected by a fine nerve with the external inferior portion of the relative pedal ganglion. The feather-like *olfactory organ* exhibited a structure exactly like that of the *Marseniæ* proper, and was provided on each side with thirty-five leaflets.

The *external mouth* (fig. 9) lay further forward on the under side of the head than in the

true *Marseniæ*. The whole rostrum, the mouth-tube, was as usual (fig. 12, *a*). The whitish bulbus pharyngeus (fig. 12) exhibited the ordinary characters; it was about 3 mm. long by 2·5 broad and 2 thick; the cartilaginous or tendinous patches (fig. 12, *b*) lay as usual on the hinder end, and the *Musculi laterales, superior* and *inferior* (fig. 12, *b*) had the normal relations. The usual radula sheath (fig. 12, *d*) projected from the cleft posterior end; when unrolled and extended it measured approximately 5 mm. The sides of the downward-directed, slit-like, internal mouth (fig. 13, *a*) each bore a firm, dull horny-yellow *lip plate*, somewhat narrowed anteriorly and posteriorly, and attaining a length of about 0·6 mm. (fig. 13, *b*, *b*). The ends of the plates did not meet. The plates were composed of as many as twenty, closely packed, indistinctly separated rows of rods, which attained a height of as much as 0·068 mm., and were slightly bent above (fig. 14). The whole internal surface of the external mouth opening was lined by a colourless, somewhat thick cuticle, shining through which the ends of the epithelial cells were visible, producing a tabulated appearance (fig. 15). The yellow radula (fig. 16) bore 20 rows of tooth plates, 9 of which were covered, while, within the sheath, there were 30 developed and 5 immature rows, making a total of 55. The tooth plates were of a bright yellow colour; the median attained a length of 0·12 mm., the lateral had a maximum height of 0·18, and the first (innermost) and second external plates measured respectively 0·17 and 0·16 mm. The sides of the *median plates* were usually parallel, four or five denticles lay on each side of the strongly developed point (figs. 16, *a*, 17, 18, 20, *a*). The form of the *lateral plates* (figs. 16, *b*, *b*, 19, *a*, 20, *b*) was essentially the same as that in the Marseniadæ generally. The basal portion was bevelled, and had a compressed conical shape, the point was turned upwards and inwards, and bent in a somewhat hook-like curve. The under surface of the basal portion (fig. 20, *b*) was broad and almost square, and in front of this lay the cleft which received the hook of the basal portion of the tooth in front (fig. 20). The basal portion passes into the small hook (fig. 19, *a*), which is bent almost at right angles and exhibits a strong sharp point; the hook has usually 6 to 12 or sometimes only 4 to 5 small denticles on the posterior upper margin, and almost always 4 of a coarser character on the turned-down anterior lower edge (figs. 16, *b*, *b*, 19, *a*). On the outside of the lateral plates, the first *external plate* was hook-shaped, upright, and strongly developed, with a broad and somewhat peculiar basal surface (figs. 19, *b*, 21, *a*); the second external tooth, outside the former and a little behind it, was less strongly developed, and had a smaller, simpler base (fig. 21, *b*). Both these external tooth plates were entirely destitute of denticles.

The *œsophagus* (fig. 12, *e*, 22, *a*) was wide, and dilated into a sort of crop posteriorly and inferiorly (fig. 22, *b*). The second crop which always occurs in the true *Marseniæ* was here entirely absent. The yellowish-white *foliated stomach* (fig. 22, *c*) was as usual hemispherical, was somewhat markedly concave on the anterior side, measured about 2·5 in length, 4·5 in maximum breadth, and as much as 2·25 mm. in height, and exhibited the ordinary foliated structure. The folia themselves were as usual; they seemed only 10 in

number, and were sometimes united in pairs at their origin on the periphery. The superior surface, part of the anterior end, but especially the under side of this stomach, were enveloped in the ordinary *glandular layer* of the Marseniadæ. This white coat extended further along the lower side of the bulbus pharyngeus, quite covering and partly enveloping the pedal ganglia. From the pyloric end of the foliated stomach a short canal extended in the usual fashion (fig. 22, *d*) to the *true stomach.* The latter was rather spacious, rounded at the right-hand end, and its walls almost without a fold. The stomach was continued on into the *intestine* almost without a boundary. The latter formed the ordinary bend (fig. 8), and ended at the anal papilla, on the left side of the vulva (fig. 27, *b*). Close to the pyloric was situated the large round bile-duct opening.

The *stomach* and the *intestine* were filled with indeterminable contents, and the rectum contained compressed white excrement balls, having a diameter of as much as 1 mm.

The *liver* was large, white externally and greyish yellow internally.

The *pericardium* and heart exhibited the usual structure. Posteriorly, on the internal wall of the former, the round pericardiaco-renal aperture was seen with unusual distinctness (fig. 24, *a*).

The *kidney* was formed of the ordinary glandular bands; the pericardiaco-renal aperture above mentioned was more distinct than the opening into the branchial cavity which lay at the base of the posterior wall somewhat to the left.

The large *foliated gland* (fig. 8, *b*) exhibited the typical structure, which was, however, specially well developed (fig. 25).

The *branchia* was provided with about 75 leaflets, which (fig. 23) hung down to a less extent and straighter than is elsewhere the case among the true *Marseniæ.* On the sides of the leaflets the characteristic transverse folds of the *Marseniæ* were also observed (fig. 23).

The *ovary* was very large, and occupied most of the posterior half of the wide, terminal, visceral winding (fig. 8, *a*). The ordinary structure was exhibited, and large oogenetic cells were seen in the lobules. The short *oviduct* led, posteriorly and to the right, into the upper end of the mucus- and albumen-gland. Behind this, shining through the thin layer of the foliated gland, the calcareous-white, spherical, *seminal receptacles* (fig. 8) could be seen. These attain a maximum diameter of 1 mm. Four were present, swollen with semen, and of almost equal size. The ducts were about twice as long as the seminal receptacles, and opened close together on the right side of the *mucus- and albumen-gland* (fig. 26, *b*). This gland (fig. 8, *c*) measured about 6 mm. in length, with a maximum breadth of 4 mm., and a thickness up to 4 mm., was of a yellow white colour, and presented the ordinary finely granular appearance (fig. 26, *a*). It consisted, as usual, of a right and a left portion, differing slightly in colour. The structure and the flattened cavity exhibited the usual characters. The *vagina* (fig. 27, *a*) was short and strongly developed; the thick, muscular diverticulum (fig. 27, *c*) about 3 mm. long, ascending along the right side of the mucus gland; the cavity was narrow, with longitudinal folds on the wall.

2. *Marseniopsis murrayi*, n. sp. (Plate I. figs. 28–38).

Habitat.—Southern Ocean, off Marion Island.

Only a single (male) specimen of this species was dredged on the 26th December, 1873, from a depth of 50 to 75 fathoms, near Marion Island.

The specimen, as preserved in alcohol, had a length of 18 mm., a maximum breadth and height of 15 and 12·5 mm. respectively. The foot was 15 mm. long, and had an anterior breadth of 6·5 mm.; the breadth of the mantle border was 4 mm., the length of the penis 7, of the tentacles 4, and of the tail 8 mm. The general *colour* was (greyish) reddish brown, the lower side of the mantle border and the neck portion were yellowish white.

The *dorsal surface* was much arched, and covered with depressed, rounded tubercles; the border of the mantle was thick and very like that of the *Onchidiopsides;* the respiratory canal was bent upwards and lay in an almost median position; the head and tentacles were as usual. The inside of the mantle, adjacent to the shell, had a reddish white colour. The *shell* measured 13·5 mm. in length, 10·5 and 8 mm. in maximum breadth and height respectively. It was very hard and brittle, and quite thin.[1]

After removing the shell, the viscera were seen in the ordinary arrangement; posteriorly, the large apparently granular, faintly reddish-yellow testis, with a narrow, dark brownish-grey border arising from the liver. In front of the testis lay the bright reddish-grey foliated gland, shining through which the somewhat darker intestine was seen. Before the former there lay a broad, glistening white band, consisting of distinctly separated portions, arranged longitudinally, and resulting from the products of the kidney and of the foliated gland. At the left corner of this band, the bright reddish-brown kidney was situated, and in front of the foliated gland the branchia and the olfactory organ could be faintly seen shining through, while the anterior end of these two organs projected somewhat markedly from the branchial cleft. The small facettes of the shell-muscles lay far forward.

The viscera of the lower body-cavity could be but indistinctly seen shining through the floor of the branchial cavity; the *vas deferens* was distinctly visible towards the root of the penis.

The *central nervous system* was exactly as in the above-described species. The *otocysts* were seen as white calcareous points, lying however more externally than in the above.

The *bulbus pharyngeus* was as before, but smaller; the lip plates exhibited the already described structure (fig. 28), and measured 0·75 mm. in length. The *tongue* was furnished with 24 rows of tooth plates, of which the first 5 were more or less defective; further back there were 40 developed and 8 younger rows, making a total of 72. The median plates had almost constantly 6 to 8 denticles on each side of the rather long pointed

[1] In the specimen examined the mantle had been opened and an attempt made to take out the shell, which had thus been broken into several pieces; these still remained, however, in their original place.

hook (figs. 29, 30). The lateral plates were more slender than in the previous species, the denticles of the posterior edge were quite minute or almost entirely absent (figs. 31, 32, 33, *a*); the two external plates were almost exactly as in the above-described form (fig. 33, *b*).

The *œsophagus* was wide and enlarged posteriorly into a crop; there was no second enlargement. The *foliated stomach* was, as before, very much hollowed anteriorly, and had a dirty brownish-yellow colour. The whole anterior half and lower surface of this stomach was enveloped in the (faintly yellow) white *glandular layer;* the posterior half of the bulbus pharyngeus, including the radula, was quite covered over by it, as also the whole of the central nervous system. The *true stomach* was almost completely surrounded by the liver, and was smaller than usual. The *intestine* exhibited a shorter bend than ordinarily, but was otherwise typical. The contents of the digestive cavity were unrecognisable animal remains.

The *liver* was very large, of a dirty brown colour, and extended up, under the testis, to the apex of the spiral. The kidney and foliated gland did not differ from those of the previously described species.

The large yellow testis exhibited the ordinary structure (fig. 34). In the lobules were seen the usual very long, hair-like spermatozoa; but besides these (figs. 35, 36) others were present, having a length of only 0·1 to 0·2 mm., and in these forms the thicker (attached) end was drawn to a sharp point, the proximal extremity also often terminating in a process. Like the others, they form large, more or less radiating groups. The *vas deferens*, arising from the testis on the right, not far from the spiral, with several short thick main branches, measured 0·7 to 1 mm. in thickness. It was white in colour, though here and there exhibiting a greenish and iridescent shimmer. It extended forwards for about 12 mm., and then became associated with the very long prostate *diverticulum*, which was rolled up within the coils of the vas deferens, and which when unrolled measured 4 cm. in length, and 0·75 to 1·5 mm. in diameter. The vas deferens extended in a coiled course to the region of the shell-muscle, measuring, when unrolled, about 3·5 cm., with a diameter of 1 to 0·75 mm. In these last coils it was more solid and muscular; then becoming thinner it was continued in small loops, within the body-wall, covered over by a thin muscular layer, to the penis. Here and there, as far as this last stretch, the vas deferens exhibited, like the diverticulum, a greenish shimmer and iridescence. The *penis* (fig. 38) had the usual long extended form, and a biconvex section; the end was a little flatter, but hardly at all broader; the opening of the seminal duct lay immediately in front of the rounded point (fig. 38, *b*); the vas deferens, accompanied by a strongly developed nerve, extended in the usual fashion through the penis.

This species, probably differing from the preceding in *colour*, is perhaps also distinguished by the *lingual armature*, in which the median plates have a more strongly toothed cutting edge and a longer hook, while the lateral plates are, on the whole, more slender, and almost entirely destitute of teeth on the upper edge of the hook.

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EXPLANATION OF THE PLATE.

Marsenia dubia, n. sp.

Figure 1.—The head, from above, with tentacles and ophthalmophoria. Cam. luc. × 100 diam.

„ 2.—The superior intestinal mass, after removal of the shell; *a*, the true stomach; *b*, the hermaphrodite gland; *c*, the foliated gland; *d*, the pericardium, at its right side the kidney;* *e*, the olfactory organ, behind it the gill; the muscular facettes very distinct to the right and left; at the anterior margin the shell-fillet.

„ 3.—*a*, the penis; *b*, protruded end of the vas deferens. Cam. luc. × 100 diam.

„ 4.—A median plate of the radula, from below. Cam. luc. × 350 diam.

„ 5.—Part of the radula, from above; *a*, median plate; *b*, *b*, lateral plates; *c*, fillet of the radula. Cam. luc. × 750 diam.

„ 6.—Lateral plate, from the under side. Cam. luc. × 750 diam.

Marseniopsis pacifica, n. sp.

Figure 7.—The shell, from the right side, × 2.

„ 8.—The superior intestinal mass after removal of the shell, × 2; *a*, ovary; *b*, foliated gland; *c*, right muscular facette, and above this the mucus gland; *d*, space between foliated gland and *e*, gill.

„ 9.—Head, from the under side, with tentacles and ophthalmophoria.

„ 10.—Central nervous system, from above; *a*, cerebral ganglia; *b*, *b*, pleural ganglia; *c*, infra-intestinal ganglion; *d*, supra-intestinal ganglion; *e*, buccal ganglia.

„ 11.—Pedal ganglia; *a*, accessory pedal ganglia; *b*, *b*, cerebro-pedal and pleuro-pedal connectives; *c*, *c*, otocysts.

„ 12.—The bulbus pharyngeus, from the side; *a*, mouth tube; *b*, cartilaginous patch; *c*, Musculus lateralis inferior; *d*, radula-sheet; *e*, œsophagus.

„ 13.—*a*, anterior margin of the labial-disc; *b*, *b*, mandibular plates.

„ 14.—Anterior part of a mandibular plate; *a*, anterior end. Cam. luc. × 350 diam.

„ 15.—Cuticula of the external mouth. Cam. luc. × 350 diam.

„ 16.—Part of radula, with three series of plates, from above. Cam. luc. × 350 diam. *a*, median plates; *b*, *b*, lateral plates; *c*, external hooks; *d*, *d*, fillet of the radula.

„ 17.—Two median plates. Cam. luc. × 350 diam.

„ 18.—Two other median plates. Cam. luc. × 350 diam.

„ 19.—*a*, lateral plate; *b*, innermost external hook. Cam. luc. × 350 diam.

„ 20.—*a*, median plates; *b*, lateral plates, from the under side. Cam. luc. × 350 diam.

„ 21.—*a*, innermost; *b*, outermost of the two external hooks; *c*, fillet of the radula. Cam. luc. × 350 diam.

„ 22.—*a*, œsophagus; *b*, wider part of the same; *c*, foliated (glandular) stomach; *d*, gut ascending to the true stomach.

„ 23.—Branchial leaf; *a*, anterior margin. Cam. luc. × 55 diam.

„ 24.—Renal organ, from the under side; *a*, pericardio-renal aperture.

„ 25.—Part of the foliated gland.

„ 26.—*a*, mucus- and albumen-gland; *b*, seminal vesicles.

„ 27.—*a*, vagina; *b*, vulva; *c*, vestibular sac.

Marseniopsis murrayi, n. sp.

Figure 28.—Transverse section of a whole mandibular plate; *a*, posterior part; *b*, anterior part.

„ 29.—Median plate, from the side. Cam. luc. × 350 diam.

„ 30.—Median plate, from above. Cam. luc. × 350 diam.

„ 31.—Lateral plate, obliquely from the under side. Cam. luc. × 350 diam.

„ 32.—Lateral plate, from the side. Cam. luc. × 350 diam.

„ 33.—*a*, lateral plate; *b*, external hooks. Cam. luc. × 350 diam.

„ 34.—Lobe of the testis; *a*, efferent duct.

Figures 35, 36.—Zoosperms.

Figure 37.—A number of Zoosperms (?) from the testis.

„ 38.—Penis; *a*, base; *b*, opening of the vas deferens.

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* The letter *e*, indicating the olfactory organ, has been omitted in the plate.

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